Refrigerant Emissions and Leakage ZERO Project

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Illustrated guide to 13 common leaks

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Illustrated guide to 13 common leaks

The Institute of Refrigeration, working with the Carbon Trust, brings you REAL Zero – Refrigerant Emission and Loss Zero. The aim of this project is in the title – zero refrigerant loss. The project offers practical assistance to everyone involved in purchasing, designing, installing, servicing, maintaining and owning refrigeration equipment to help them reduce leaks.

Refrigeration and air conditioning service and maintenance engineers can have a significant impact on refrigerant leakage.

- Good service and maintenance reduces current leaks and leakage potential.
- Inadequate service and maintenance can increase the risk of leakage and hence increase the environmental impact of RAC systems.

To make your service and maintenance more effective in reducing leaks it helps to know the common leak points – here are the top 13. The causes of leaks at each point are explained as is, more importantly, how they can be avoided. For more details about leakage reduction, see the Guide to good leak testing from www.realzero.org.uk

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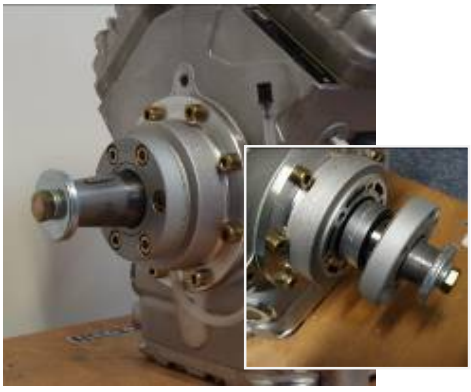
Leak point	Likely causes	Solutions
1. Shut-off and ball valves 	• Wear of the packing gland between the valve body and spindle shaft as it becomes compacted with age and use. • Overheating during installation. • Caps not fitted.	• Ensure that the gland is tightened. • Wrap the valve with a damp rag while brazing.  **Always cap valves – most leaks occur at uncapped valves.**
2. Schrader valves 	**Likely causes** • Valve cores damaged during brazing. • The cores not tightened correctly during replacement. • Deterioration of internal seals over time. • Caps not fitted or have no O-ring seal.	**Solutions** • Remove the core when brazing the fitting in; ensure the valve body has cooled before replacing the core. • Use the correct tool to replace / tighten the core. • Ensure the cap is fitted and has a seal (in good condition) in place.
3. Flare joints 	**Likely causes** • Loosening of the flare nut due to thermal expansion / contraction due to a wide temperature variation, especially where those at the outlet of expansion valves. • Poor joint preparation (causing leakage from initial	**Solutions** Where possible, avoid using flare connections. If they cannot be avoided: • Use flare solder adaptors (factory produce flares). Ensure the copper seal is located correctly. • If you have to make a flare, cut the pipe work with a pipe cutter and de-burr using the correct tool. Use an eccentric flaring tool and ensure the correct amount of pipe is protruding through your flaring block.

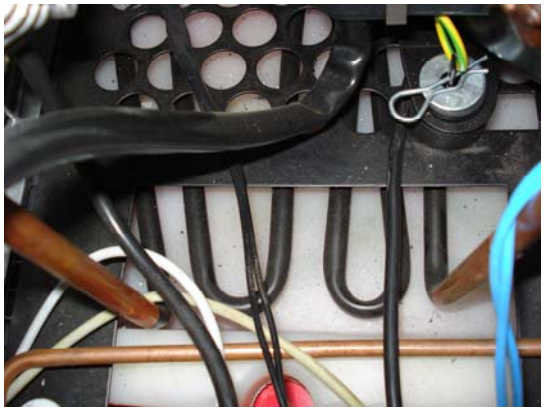
Flare joints continued..	installation). • Over tightening, leading to damage at the copper flare face and the flare nut. • Under tightening of the flare.	• Check the flare size and that it does not foul the flare nut on the pipe. • Lubricate the flare and nut face with a small amount of refrigeration grade oil. • Don't over or under tighten the flare nut – use a torque wrench to the setting provided by the equipment manufacturer.
4. Mechanical joints and flanges There are a variety joints and flanges on a system e.g. drier core lids etc. 	**Likely causes** • Incorrectly prepared joint Not replacing gaskets. • Uneven tightening of flanges. • Incorrectly torque used for tightening bolts.	**Solutions** • Avoid using PTFE on HFC refrigerants - use an appropriate thread sealant • Replace gaskets on flanges and remove all the old gasket material before applying the new one. • Tighten flanges down evenly applying the 'opposites' rule until the flange is seated correctly. • Use a torque wrench to carry out the final tensioning of flange bolts.
5. Pressure relief valves (PRVs) and fusible plugs (over-pressure protection) 	**Likely causes** • **Fusible plugs** – wide temperature and / or pressure variations weaken the bond between the solder core and the plug. • **PRVs** - do not reseat when the pressure drops after release and often leak across the PRV	**Solutions** **Fusible plugs** • Where possible, avoid using fusible plugs. If possible, replace them with a PRV. • Always leak test fusible plugs. **PRVs** • Always leak test the outlet of PRVs. • If a PRV is leaking replace it with an

PRVs continued	seat during normal operation.	equivalent rated device. • Do not cap the PRV if it is leaking. • Use dual PRVs with a change over valve where possible. • Use a bursting disc in conjunction with the PRV where possible. It forms part of the PRV assembly and often has a tell tale gauge to indicate rupture.
6. Shaft seals (open type compressors) 	**Likely causes** • General wear over time, indicated by an increased oil loss from the shaft seal or refrigerant leakage. • Lubrication failure. • Incorrect fitting of a new shaft seal. • Incorrect shaft alignment. • Excessive crankshaft end float or bearing damage.	**Solutions** • Regular observation of oil leakage rate into shaft seal collection vessel to check oil loss does not increase. • Leak testing of the shaft seal with the compressor switched off. • Using the correct type of shaft seal and following the proper procedure when replacing the shaft seal.
7. Condensers 	**Likely causes** **Shell and tube condensers** • Corrosion of the copper and mild steel if the water circulating in the tubes is not treated correctly. Leaks can be particularly hard to locate, as they cannot be	**Solutions** **Shell and tube condensers** • Ensure adequate corrosion prevention scheme is in place e.g. chemical dosing. • Regular inspection to monitor potential corrosion level. • Regular maintenance and monitoring. Where a leak has occurred in the tube bundle it is often false economy to

condensers continued	seen – refrigerant might be detected in the water, but usually the leak is only detected by carrying out a full pressure test of the system. **Air-cooled condensers** • Corrosion due to aggressive air. • Impact damage due to foreign bodies in the air stream. • Vibration causing premature failure of the tube bundle.	replace one tube, as the rest of the tubes are probably in a similar condition and will fail. **Air cooled condensers** • Always position condensers on a level base. • Repair or replace out of balance fans. • Check the fin block for signs of oil. • When replacing a condenser, select it carefully, especially if it is going into an aggressive environment e.g. on the coast.
8. Line tap valves 	**Likely causes** • Poor fitting of the line tap onto the pipe, or being fitted to badly formed or flattened pipe work. • Use of the wrong size line tap • Loosening of the line tap valve due to movement and vibration.	**Solutions** • Ensure the correct size of tap valve is being used and read the instructions for its installation. • Fit a line tap to access a system, and then braze a Schrader connector to replace it – **do not leave the line tap valve on the system**. • Leak test any line taps found fitted and replace them if possible.

Leak point	Likely causes	Solutions
9. Pressure switches 	• Vibration causing the pressure coupler to split or damage to the pressure switch. • The pressure coupler chafing. • Rupture of the switch bellows due to vibration or liquid hydraulic action. • Failure of the flare connection onto the switch. • Poorly supported or fixed switch body.	• Use flexible pressure couplers where possible (stainless steel braided type offer a high degree of strength and mechanical protection). • Make sure pressure couplers do not rub or chafe on other pipes or vibrating surfaces. • Ensure the switch is correctly supported / fixed. • Use flare solder adaptors on the switch where copper pipe is being used. • Use dual bellows switches where possible. • Connect the switches to minimise the transfer of vibration into the switch. • Always leak test inside switches (be aware of the risk of electric shock).
10. O-rings O-rings are widely used in components such as sight glasses, solenoid valves and shaft seals. 	• Wear, hardening or flattening, especially when subjected to extremes of temperature. • Leakage after retrofitting because of a different reaction to the new oil.	• Check (for roundness and flexibility) and change seals rather than re-using the existing ones, especially during a refrigerant retrofit. • Oil seals before fitting them. • Ensure the replacement seal is suitable for the system oil and refrigerant.

Leak point	Likely causes	Solutions
11. Capillary tubes (pressure couplers and expansion devices) 	• Chafing due to insecure fixing. • Leakage where a capillary tube expansion device enters / exits the suction line.	• Check capillary tubes are firmly located and cannot chafe – correct if necessary.
12. Return bends on evaporators and condensers 	**Likely cause** • Corrosion due to chemical action on the return bends on coolers or air cooled condensers. Since the copper used in these heat exchangers is thinner than normal copper pipe work, a surface pinhole is likely to result in a leak in a relatively short period of time. Aggressive environments (such as a salty or acidic atmosphere) accelerate damage and hence leakage.	**Solutions** • Leak test return bends carefully, especially if the atmosphere is aggressive (e.g. in food factories where salad is washed in chlorine-treated water; where vinegar products are made; close to the sea). • If evaporators and condensers that are prone to leaks from return bends are to be replaced, specify materials which are less susceptible to damage such as coated or electro plated heat fin blocks. • When chemical cleaners are used ensure they are totally washed off.

Leak point	Likely causes	Solutions
13. Condensate tray pipe work 	• Corrosion of the discharge line because of contact with air and water.	• Always leak test in the vaporiser tray and check the condition of the pipe work. If it is corroded, replace the pipe work before it fails. • Where possible, replace the pipe work with a plastic coated type as this extends the life dramatically.